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The time period for reply, if any, is set in the attached communication.



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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/812,653
Filing Date: March 29, 2004
Appellant(s): LIEBER ET AL.

Timothy J. Oyer, Ph.D. (Reg. No. 36,628)
and
Tani Chen, Sc.D. (Reg. No. 52,728)
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 9/1/2009 appealing from the Office action mailed 1/2/2009.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,774,414	Melzner et al.	6-1998
6,445,006	Brandes et al.	9-2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claim 123 is rejected under 35 U.S.C. 103(a) as being unpatentable over Melzner et al. (U.S. Patent No. 5,774,414) and Brandes et al. (U.S. Patent No. 6,445,006).

Melzner et al. show most aspects of the instant invention (e.g. Figures 2 and 3) including an electrical crossbar array comprising a plurality of crossed conductors 3,11 defining memory elements switchable, via the application of electrical potentials, between two readable states **U,O**, one of the wires deformable (i.e. movable) from a first position to a second position to turn "on" or turn "off" said memory elements.

Melzner et al. do not show the one of the conductors to be a nanotube. Brandes et al. teach (e.g. Figure 9 and Column 2 Lines 31 to 40) to use nanotubes in MEMS devices to capitalize on the semiconducting properties of carbon nanotubes (Column

8 lines 1 and 2) and their unique mechanical and electrical properties (Column 8 Lines 62 to 66). It would have been obvious to a person of ordinary skill in the art at the time of invention to have wires in electrical or Van der Waals contact and made of nanoscopic single or multiwall carbon nanotubes and auxiliary circuitry including transistors, capacitors and contact electrodes as taught by Brandes et al. in the device of Melzner et al. to capitalize on the semiconducting properties of carbon nanotubes and their unique mechanical and electrical properties.

(10) Response to Argument

A. Claim 123 is not unpatentable over the combination of Melzner et al. and Brandes et al.

In this section, the Appellants state that the sole motivation of combining the prior art is "to capitalize on the semiconducting properties of carbon nanotubes" and they reason that combining the prior art is insufficient to overcome the different devices described in the references. However, the Appellants' statement is incomplete. The complete motivation for combining the prior art can be found in Brandes et al. reason is as stated in the rejection above: "to capitalize on the semiconducting properties of carbon nanotubes (Column 8 lines 1 and 2 of Brandes et al.) and their unique mechanical and electrical properties (Column 8 Lines 62 to 66 *ibid*)."

The Appellants' characterization of Brandes et al.'s application of nanotubes as being restricted to sensors is also incorrect. Brandes et al. describe "a wide variety of devices may be formed using a carbon microfiber (nanotube) as part of the active device (Column 7 Lines 53 and 54)." These devices range from semiconductor devices used in memories such as diodes (e.g. Figure 9A) and MOSFETs (e.g. Figure 10) to

microelectromechanical (MEMS) devices of which the invention of Meltzer et al. is an example. Also, as stated below, the MEMS device shown in figures 11 to 13 are illustrative and non-limiting. The Examiner's rejection is just the substitution of the nanotubes of Brandes et al. for the conductors used in Meltzer et al.

1. The rejection of claim 123 should be reversed because the Examiner has not established a prima facie case of obviousness over the combination of Melzner and Brandes

In this section the Appellants concentrate on the use of "capitalize" in the first motivation statement of the Examiners rejection as being too vague and insufficient. As stated above, this is an incomplete statement of the motivation to combine the prior art. As stated in Brandes et al. (Column 8 Line 62 to Column 9 Line 3):

"The unique mechanical and electrical properties of carbon nanotubes enable a variety of novel electromechanical devices to be produced, when a suitable method of incorporating the carbon nanotube (microfiber) into the device is employed. The catalyst patterning and carbon nanotube growth process of U.S. Pat. No. 5,872,422 provides a useful approach for accomplishing this result. FIGS. 11, 12 and 13 show various illustrative microelectromechanical devices produced using carbon nanotubes."

This paragraph states one motivation to use nanotubes (take advantage of their unique mechanical and electrical properties) and a suggested method to incorporate them into any device. The examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir.

1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the motivation to combine the prior art is stated, in part, in the quoted paragraph above: to take advantage of the take advantage of the unique mechanical and electrical properties of nanotubes in addition.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). Brandes et al. teach that nanotubes are equivalent semiconductor and electromechanical material which one of ordinary skill in the art can incorporate into any device when a suitable method is used.

In response to applicant's argument that Brandes et al. and Melzner et al. are nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, both references are concerned with MEMS and other semiconductor devices.

2. The rejection of claim 123 should be reversed because on of ordinary skill in the art would not have had any reason to combine Melzner and Brandes.

In response to Melzner et al. not mentioning anything about nanotubes, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). It is the combination of Melzner et al.'s electrical crossbar array with the nanotubes of Brandes et al. that render the instant invention obvious.

In reference to Brandes et al.'s nanotubes not shown to be under compressive stress condition and the devices being sensors with nanotubes with a free end not under compressive stress, the characterization by the Appellants that the nanotubes can not be fixed on both ends is incorrect. Nanotubes having fixed ends are shown in Figures 9 and 10. The MEMS sensors shown in Brandes et al. (Figures 11 to 13) are "various illustrative microelectromechanical devices produced using carbon nanotubes" (Column 9 Lines 1 to 3) and are not limiting. Variations, modifications and other embodiments suggested by themselves to those of ordinary skill in the art (Column 10 Lines 17 to 24) are also suggested and encouraged by Brandes et al. Those embodiments in the stated figures do illustrate the flexibility and versatility of nanotubes as main agents in MEMS devices with properties directly applicable to the device of Melzner et al. The diaphragm in the device of Melzner et al. can be duplicated, for example, using bunched or bundles of nanotubes. In this way, the stresses encountered would be compensated by the added nanotubes but would remain flexible enough to

work in the memory of Melzner et al. Disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. *In re Susi*, 440 F.2d 442, 169 USPQ 423 (CCPA 1971).

3. The rejection of claim 123 should be reversed because the results of the substitution or combination would not have been predictable to a person of ordinary skill in the art nor would have the person of ordinary skill have been able to combine Melzner and Brandes to form a working device with a reasonable expectation of success.

In this last section, the Appellants state that the substitution of a nanotube in the device of Melzner et al. would not produce a functional device and would not be predictable to one of ordinary skill in the art. The Appellants quote the declaration of one of the inventors, Prof. Charles Lieber, who states that, in his opinion, the combination of the prior art would not work and be unstable. However, if this is true, then the Prof. Lieber and the other Appellants must explain how the nanowires of their invention are functional. Nanowires, **207**, shown in Figure 8 of the Specification, are bent in a similar fashion to Melzner et al.'s diaphragm **3**. Their wires would be under similar stress. If these nanowires would not be stable or flexible enough when put into the configuration of the device of Melzner et al., how are the nanowires of the instant invention able to withstand the stress? In both inventions, the nanowires can be bent by electrical means and therefore, experience similar stresses. As the stated above, one of ordinary skill could reinforce the nanowires by bunching them together. However, the instant invention only uses a single nanowire.

In response to applicant's argument that the device would not be operable, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Brandes et al. suggest to replace the flexible conductor in Melzner et al. for those reasons stated in the rejection above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Howard Weiss/
Primary Examiner
Art Unit 2814

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/Wael M Fahmy/
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/Tom Thomas/

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Business Process Specialist, TC 2800